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拒絶理由通知書

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起案日	平成１７年 ９月 ５日	
特許庁審査官	石井 研一	８１２４ ５Ｋ００
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適用条文	第２９条第２項	

この出願は、次の理由によって拒絶をすべきものである。これについて意見があれば、この通知書の発送の日から６０日以内に意見書を提出して下さい。

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請求項１について、
引用刊行物
（１）特開平０８－２６５０４８号公報 √

備考
図１ないし図２を参照、本願請求項と同様なミキサが記載されているものと認められる。
なお、高周波回路部品において、グランド端子を他の信号端子の間に配置して、端子間の分離、遮蔽を図る事は慣用手段と認められる。
必要とあれば下記公報なども参照されたい。
（２）実願平０４－０６７００１号のＣＤ－ＲＯＭ（実開平０６－０３１２１２号公報）、段落００１２，００１３および図４参照）
（３）特開２０００－０４９６５１号公報（段落００２８，００６０等を参照）
（４）特開平１１－３１３００３号公報（段落００５４）

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整理番号 ３０－１２６３Ｐ

発送番号 ３３５０８５ 2/E
発送日 平成１７年１０月 ４日

現時点では、拒絶の理由を発見しない。拒絶の理由が新たに発見された場合には拒絶の理由が通知される。

先行技術文献調査結果の記録

・調査した技術分野 ＩＰＣ第７版 Ｈ０４Ｌ１１／２０
・先行技術文献

この先行技術文献調査結果の記録は、拒絶理由を構成するものではない。

PATENT ABSTRACTS OF JAPAN

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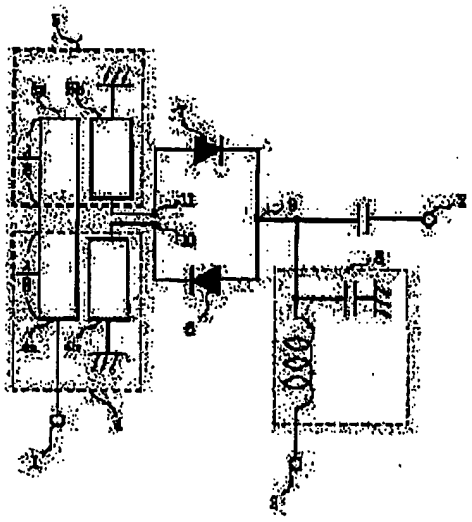
(54) MIXER CIRCUIT

(57)Abstract:
PURPOSE: To obtain the small sized and broad band mixer circuit operated at a low local oscillation signal level by improving impedance patching with respect to an input signal.
CONSTITUTION: Merchant baluns 4, 5 are made up of two coupling transmission lines with nearly 1/8 wavelength with respect to the operating frequency. The signal received from a local oscillating input terminal 1 is converted into a signal in the balance mode at terminals 10, 11 with the merchant balun comprising the coupling lines 4, 5 and the signal is given to diodes 6, 7. Furthermore, an RF signal is given from an RF signal terminal 2 connecting to a connecting point 9 of the diodes 6, 7. Both the signals are converted by a nonlinear effect of the diodes 6, 7 and they are appeared at an output terminal 3 as an intermediate frequency signal through a low pass filter 8. The circuit is especially proper to a monolithic microwave integrated circuit.



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* NOTICES *

CLAIMS

[Claim(s)]

[Claim 1] The 1st and the 2nd tie way where the track and end of 1 by which the end was connected to the 1st input terminal / 6 - 1/10 wave of die length consisted of a track of 1 constituted by the open end / 6 - 1/10 wave of die length, and each other end was connected through direct or a track, 1 from which it combines with said 1st and 2nd tie ways, respectively, an end short-circuits, and the other end serves as a balanced terminal / the 3rd of 6 - 1/10 wave of die length, and the 4th tie way, The series connection diode of a pair connected to the balanced terminal of said 3rd and 4th tie ways, The mixer circuit characterized by having the 2nd input terminal connected at the node of said series connection diode, and the output terminal connected through the low-pass filter at the node of said series connection diode.

[Claim 2] Said 1st and 2nd tie ways consist of a track of 1 / 6 - 1/10 wave of two or more die length, respectively. Connect mutually and each ends and many items of two or more of a track are constituted. Said 3rd and 4th tie ways consist of two or more tracks of 1 combined with two and one track of two or more of said tracks which constitutes said 1st and 2nd tie ways, respectively / 6 - 1/10 wave of die length. The mixer circuit according to claim 1 characterized by connecting mutually and constituting each end and other end.

[Claim 3] The 1st and the 2nd tie way where the track and end of 1 by which the end was connected to the 1st input terminal / 3 - 1/5 wave of die length consisted of a track of 1 constituted by the open end / 3 - 1/5 wave of die length, and each other end was connected through direct or a track, 1 from which it combines with said 1st and 2nd tie ways, respectively, an end short-circuits, and the other end serves as a balanced

terminal / the 3rd of 3 - 1/5 wave of die length, and the 4th tie way, The series connection diode of a pair connected to the balanced terminal of said 3rd and 4th tie ways through the track of 1 / 3 - 1/5 wave of die length, respectively, The mixer circuit characterized by having the output terminal connected to the track where the end was connected at the node of said series connection diode, and the 2nd input terminal was connected to the other end, and said track connected at the node or this node of said series connection diode through the low-pass filter.

[Claim 4] Said 1st and 2nd tie ways consist of a track of 1 / 3 - 1/5 wave of two or more die length, respectively. Connect mutually and each ends and other ends of two or more of a track are constituted. Said 3rd and 4th tie ways consist of two or more tracks of 1 combined with two of two or more of said tracks which constitute said 1st and 2nd **** tracks, and one, respectively / 3 - 1/5 wave of die length. The mixer circuit according to claim 3 characterized by connecting mutually and constituting each end and other end.

[Translation done.]

* NOTICES *

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1.This document has been translated by computer. So the translation may not reflect the original precisely.

2.**** shows the word which can not be translated.

3.In the drawings, any words are not translated.

DETAILED DESCRIPTION

[Detailed Description of the Invention]

[0001]

[Industrial Application] This invention relates to the mixer circuit used for the radio communication equipment of microwave and a millimeter wave.

[0002]

[Description of the Prior Art] Generally, the mixer circuit of a single balance mold is constituted, as shown in drawing 8 . In drawing 8 , the balun from which a RF signal (following RF signal) input terminal and 51 change an unbalance signal into an intermediate frequency signal (following IF signal) output terminal, and 49 changes 52 into a balanced signal for a local dispatch signalling frequency (following office dispatch number) input terminal and 50, the low pass filter (henceforth, LPF) with which mixer diode and 55 prevent the middle point of diode, 56 prevents an office dispatch number and a RF signal, and 53 and 54 pass only an IF signal, and 57 and 58 are nodes. By the balun 52, the station dispatch number impressed to the station dispatch number input terminal 49 is changed into a balanced mode, joins nodes 57 and 58, and drives diode. A RF signal is added to diode from an input terminal 50, and the IF signal generated for diode is outputted from the IF output terminal 51 through LPF56.

[0003] When a microwave band realizes a mixer circuit, in the Prior art, what constituted the rat race circuit, the branch line circuit, etc. from a microstrip line on the same flat surface, and the thing which formed and constituted the pattern to both sides of a microwave integrated circuit (Media Interface Connector) substrate with the slot line are used for the balun which changes unbalance mode into a balanced mode.

[0004] Drawing 9 is the single mixer which used the rat race circuit for the balun, and 59 is an office dispatch number input terminal and LPF which mixer diode, and 64-67 pass a node, and an IF signal output terminal, and 62 and 63 make, as for 68, pass [60 / 61 / a RF-signal input terminal and] an IF signal. It is the track length of the quarter-wave length of an operating frequency between nodes 64-65, 65-66, and 66-67, and is 3/4 wave of track length during a node 67-64. Although a station dispatch number is inputted from an input terminal 59 and it appears at nodes 64 and 66, at this time, the phase contrast of the signal of nodes 64 and 66 is 180 degrees, serves as a balanced mode and joins the mixer diodes 62 and 63.

[0005]

[Problem(s) to be Solved by the Invention] Although it turns [mixer circuit / using the above rat race circuits] to flat-surface circuit-ization by the microstrip line, it takes a location from the configuration and does not turn [location] to a miniaturization. Moreover, the band which can take a property is also comparatively narrow. When constituted from a slot line, it becomes a three-dimensional thing using both sides of a Media Interface Connector substrate, and a configuration becomes complicated compared with a flat-surface circuit.

[0006] Besides the above-mentioned unbalance-balance conversion circuit generally used well, it consists of the two joint transmission lines of the quarter-wave length of an

operating frequency, and 180-degree phase shifter of the two joint transmission lines which short-circuited the end, respectively, made the end disconnection, and was connected is called MACHANTOBARAN, and can do a miniaturization easily in a broadband. For example, A Designer's Guide To Planer Mixer There is an example made the configuration of a DABURUPA lance mixer using MACHANTOBARAN in Baluns (Microwaves December 1979 p52-57). However, wiring to diode will become three-dimensional and the effectiveness of flattening of a balun will become useless so that it is necessary to use two baluns in order to form double balance, and the example of said paper may see further. Although the merit of a double balance configuration has taken isolation in all the terminals of the mixer of a signal input, a station dispatch number input and a station dispatch number input, IF output and a signal input, and IF output and is that there is little fluctuation of the mixer property by connection of a load Since the load conditions of a station dispatch number also with the single balance configuration especially important for the property of a mixer which takes two isolation of a signal input, a station dispatch number input and a station dispatch number input, and IF output are decided, it is practical enough, and since a balun can also be managed with one piece, a configuration also becomes simple.

[0007] The circuitry of the single balance mixer which used MACHANTOBARAN for drawing 10 is shown. In a station dispatch number input terminal and 70, a RF-signal input terminal and 71 have 72 by MACHANTOBARAN, and an IF signal output terminal and 73 have [69] the two quarter-wave length joint transmission lines. As for LPF to which 74 and 75 let mixer diode pass and 76 lets IF frequency pass, and 77 and 78, the node of MACHANTOBARAN and mixer diode and 79 are the middle points of diodes 74 and 75. The station dispatch number inputted from 69 is changed into a balanced mode by association with track 72a, and 72b, 73a and 73b, joins nodes 77 and 78, and drives diode. The RF signal inputted from the input terminal 70 is added to diode, and the IF signal generated for diode is outputted from the IF output terminal 71 through LPF76.

[0008] The conversion loss property of Media Interface Connector which designed by 5GHz to drawing 11 by the circuitry of <A HREF="/Tokujitu/tjitemdrw.ipdl?N0000=239&N0500=1 E_N/;?7=9:?;7///&N0001=610&N0552=9&N 0553= 000012" TARGET="tjitemdrw"> drawing 10, and was made as an experiment on the alumina substrate is shown. Quarter-wave length is 5.4mm about. As shown in drawing 11 , even if it inputs 15dBm of 5GHz office dispatch numbers, conversion loss is about 15dB, and is not the engine performance good as a mixer. Moreover, the return loss property of this Media Interface

Connector is shown in drawing 12 . As this property shows, in about 5GHz, return loss is inadequate (a reflective signal is size) very much.

[0009] Thus, in the circuitry of drawing 10 , the impedance seen from the RF-signal input terminal side is in an open condition on a design frequency, and is understood that an adjustment condition with a signal is not good.

[0010] It aims at this invention solving the conventional above problems, and realizing low conversion loss to a broadband on low station dispatch number level in the single balance mold mixer which consists of flat-surface circuits, and making a miniaturization possible more.

[0011]

[Means for Solving the Problem] This invention is set to a mixer circuit in order to solve the above-mentioned technical problem. The 1st and the 2nd tie way where the track and end of 1 by which the end was connected to the 1st input terminal / 6 - 1/10 wave of die length consisted of a track of 1 constituted by the open end / 6 - 1/10 wave of die length, and each other end was connected through direct or a track; On said 1st and 2nd tie ways, each 1 from which it joins together, an end short-circuits, and the other end serves as a balanced terminal / the 3rd of 6 - 1/10 wave of die length, and 4th tie way, The series connection diode of a pair connected to said 1 / balanced terminal of the tie way of 6 - 1/10 wave of die length, It is characterized by having the 2nd input terminal connected at the node of said series connection diode, and the output terminal connected through the low-pass filter at the node of said series connection diode.

[0012] Moreover, the 1st and the 2nd tie way where the end consisted of a track of 1 connected to the 1st input terminal / 3 - 1/5 wave of die length as other means, and each other end was connected through direct or a track, 1 from which it combines with said 1st and 2nd tie ways, respectively, an end short-circuits, and the other end serves as a balanced terminal / the 3rd of 3 - 1/5 wave of die length, and the 4th tie way, The series connection diode of a pair connected to the balanced terminal of said 3rd and 4th tie ways through the track of 1 / 3 - 1/5 wave of die length, respectively, It is characterized by having the output terminal connected to the track where the end was connected at the node of said series connection diode, and the 2nd input terminal was connected to the other end, and said track connected at the node or this node of said series connection diode through the low-pass filter.

[0013] Furthermore, in said both mixer circuit means, said 1st and 2nd tie ways consist of two or more tracks, respectively. Connect mutually and each ends and other ends of two or more of a track are constituted. It is characterized by for said 3rd and 4th tie ways consisting of two or more tracks combined with two of two or more of said tracks

which constitute said 1st and 2nd tie ways, and one, respectively, and connecting mutually and constituting each end and other end.

[0014]

[Example] The example of this invention is explained referring to a drawing below.

[0015] Drawing 1 is the circuit diagram of the mixer circuit in one example of this invention. A different point from the configuration of conventional drawing 10 in drawing 1 is a point that used MACHANTOBARAN consists of the two abbreviation [for a design frequency / one fourth of / 1/8 wave of abbreviation instead of wavelength] joint transmission lines.

[0016] Namely, tie way 4a of the die length of the wavelength of the abbreviation 1/8 by which, as for the joint transmission line, the end was connected to the station dispatch number input terminal 1, As the whole with which it has tie way of 1/8 wave of abbreviation from which end was constituted by open end 5a, and each was combined in the other end (center), the unbalanced line of abbreviation quarter-wave length, It has the configuration of the tie ways 4 and 5 which consist of the tie ways 4b and 5b of the die length of 1/8 wave of abbreviation where it was combined with the tie ways 4a and 5a of the die length of the wavelength of said abbreviation 1/8, respectively, the end short-circuited, and the other end was used as the balanced terminals 10 and 11.

[0017] Moreover, between said balanced terminal 10 and 11, series connection of the mixer diodes 6 and 7 is carried out, and the RF-signal input terminal 2 and the IF signal output terminal 3 are connected through the transmission line and low-pass filter 8 grade at the node, respectively.

[0018] Drawing 2 is other examples which constituted the mixer circuit shown in drawing 1 from a Media Interface Connector pattern formed on dielectric substrates, such as an alumina.

[0019] The mixer circuit of drawing 2 is considering the configuration of the tie ways 15 and 16 as the compound configuration of two or more tie ways. The track by the side of unbalance connects the track of the die length of 1/8 wave of four abbreviation to H configuration. Arrange and an open end and a signal input edge are considered as the configuration connected by wire bonding etc., respectively. Moreover, the track of the balancing side connects and arranges the track of the die length of 1/8 wave of four abbreviation in a KO configuration, and short-circuits the mutual connection track section, and considers a mutual open end as the configuration connected by wire bonding etc., respectively, and the both line way is made into the tie ways 15 and 16 of a configuration of having engaged mutually.

[0020] Moreover, between the balanced terminal 21 and 22, series connection of the

mixer diodes 17 and 18 is carried out, and the RF-signal input terminal 13 and the IF signal output terminal 14 are connected through the transmission line, the compound track of a low-pass filter 19, etc. at the node 20, respectively. The tie ways 15 and 16 constitute MACHANTOBARAN which consists of the open transmission line by the side of the unbalance of 1/8 wave of abbreviation for a design frequency, and the two short circuit transmission lines of 1/8 wave of abbreviation for the balancing side, and a low-pass filter 19 prevents a RF signal and a station dispatch number, and passes an IF signal.

[0021] By taking the compound configuration of such a tie way, the joint property of an unbalance balance can be made good, and the balance of the balancing side can be improved further, and impedance matching can be improved.

[0022] The frequency characteristics of the conversion loss of Media Interface Connector and the office dispatch number level dependency which designed the circuitry of drawing 2 by 5GHz, and were made as an experiment on the alumina substrate are shown in drawing 3 . Conversion loss is saturated with station dispatch number level 5dBm, and conversion loss is about 6dB. The band obtained 4.2-5.7GHz to the design frequency of 5GHz. The big improvement was found as compared with the property of the configuration of conventional drawing 10 . If office dispatch number level dependence of the return loss seen from the RF-signal terminal is investigated, like drawing 4 , on low station dispatch number level, the return loss seen from RF terminal will change a lot, and will become the best with design frequency the band of 5GHz. Compared with the configuration of conventional drawing 10 , it has improved greatly. Moreover, since the track length of MACHANTOBARAN was usually made into one half and impedance matching is improved, the area of the flat-surface circuit of a balun becomes abbreviation half [conventional], and can be miniaturized.

[0023] Drawing 5 is the circuit diagram of the mixer circuit of other examples of this invention. A different point from the configuration of conventional drawing 10 in drawing 5 is a point of having formed the transmission lines 28 and 29 of the abbreviation quarter-wave length of an operating frequency between the balanced side edge children 34 and 35 of usual MACHANTOBARAN, and the mixer diodes 30 and 31.

[0024] Although the tie way of the balancing side is the die length of abbreviation quarter-wave length and its impedance is high, by connecting the tracks 28 and 29 of abbreviation quarter-wave length to the balanced terminal further, the transmission-line length which saw from the diode side is lengthened, and it makes it possible to lower an impedance as a result and to raise adjustment.

[0025] Drawing 6 is other examples which constituted the mixer circuit shown in

drawing 5 from a Media Interface Connector pattern formed on dielectric substrates, such as an alumina. MACHANTOBARAN which a station dispatch number input terminal and 37 become from a RF-signal input terminal and the two quarter-wave length short circuit transmission lines usual [38] in an IF signal output terminal, and 39 and 40 in 36, and 41 and 42 are LPF which the quarter-wave length transmission line, and 43 and 44 pass mixer diode, and 45 makes pass an IF signal.

[0026] The tie way was considered as the configuration of the same compound track as drawing 2 , and improvement in the balance of a balanced outgoing end and impedance matching are improved.

[0027] The office dispatch number level dependency of the frequency characteristics of the conversion loss of Media Interface Connector which designed the circuitry of drawing 6 by 5GHz, and was made as an experiment on the alumina substrate is shown in drawing 7 . Compared with the former, the improvement of the property of a mixer almost comparable as the example of drawing 1 was found, and the mixer circuit of low conversion loss has been realized to the broadband on low station dispatch number level in the flat-surface circuit.

[0028] Although the example which adopted the die length of 1/8 wave or quarter-wave length as track length of a tie way explained the mixer circuit in each above-mentioned example In this invention which considered MACHANTOBARAN using the tie way of 1/several waves of die length of a design frequency as the basic configuration From an easy thing pulling out a desired property by excelling in broadband nature and an impedance matching property, and taking adjustment with an I/O circuit into consideration Track length does not necessarily have to make it correctly the die length of the 1/8 wave or quarter-wave length of a design frequency, and can realize the desired engine performance enough also by the die length before and behind that.

[0029] As a setting range of this invention, about 1/8 wave of track, it is 1/6 to 1/10 wave of range, and, in the case of the track of quarter-wave length, it is possible to carry out in 1/3 to 1/5 wave of range. Moreover, it is clear that it can carry out even if it constitutes each short circuit one end and balanced one end from two tie ways changed mutually as a balancing-side configuration of the tie way of this invention.

[0030]

[Effect of the Invention] As mentioned above, [whether in the mixer circuit using nonlinear devices, such as MACHANTOBARAN and diode, it constitutes by carrying out MACHANTOBARAN in what consists of the two joint transmission lines of 1/8 wave of abbreviation for an operating frequency, and] Or by preparing the transmission line of abbreviation quarter-wave length between the balanced terminal of

MACHANTOBARAN which consists of the two joint transmission lines of the usual abbreviation quarter-wave length, and a nonlinear device The impedance matching over the input signal and station dispatch number of a mixer circuit is improved, and the broadband mixer circuit of low conversion loss which operates on low station dispatch number level can be realized small in a flat-surface circuit. Moreover, this invention is suitable for especially the monolithic microwave integrated circuit with easy implementation of the tie way where precision is high, and it is possible to attain the miniaturization of equipment.

[Translation done.]

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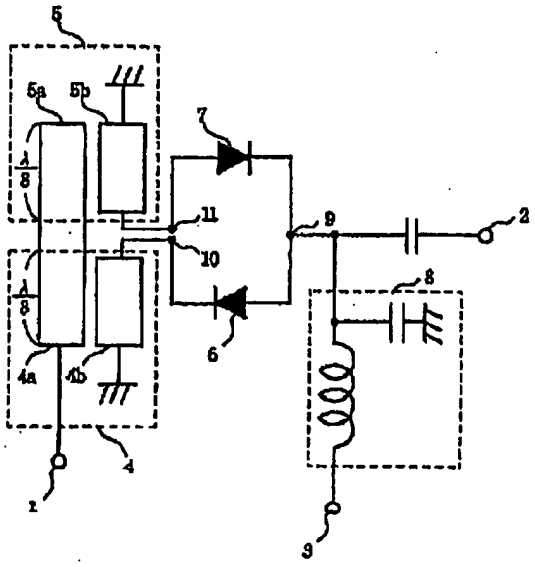
(54)【発明の名称】ミキサー回路

(57)【要約】

【目的】入力信号に対するインピーダンス整合を改善し、低局発信号レベルで動作する小型で広帯域なミキサー回路を提供する。

【構成】マーチャントバラン4，5を使用周波数の略1／8波長の結合伝送線路2つから成る構成とする。局発入力端子1から入力された信号は、結合線路4と結合線路5からなるマーチャントバランによって端子10，11で平衡モードの信号に変換されダイオード7，8に入力される。また、ダイオード7，8の接続点9に接続されたＲＦ信号端子2からＲＦ信号が入力される。前記両信号はダイオードの非線形効果によって変換され、ローパスフィルター8を通して中間周波数として出力端子3に現れる。モノリシックマイクロ波集積回路に特に適している。



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【特許請求の範囲】

【請求項1】 一端が第1の入力端子に接続された1／6～1／10波長の長さの線路及び一端が開放端に構成された1／6～1／10波長の長さの線路からなりそれぞれの他端が直接又は線路を介して接続された第1及び第2の結合線路と、前記第1及び第2の結合線路にそれぞれ結合し一端が短絡され他端が平衡端子となる1／6～1／10波長の長さの第3及び第4の結合線路と、前記第3及び第4の結合線路の平衡端子に接続された一対の直列接続ダイオードと、前記直列接続ダイオードの接続点に接続された第2の入力端子と、前記直列接続ダイオードの接続点に低域濾波器を介して接続された出力端子とを有することを特徴とするミキサー回路。

【請求項2】 前記第1及び第2の結合線路はそれぞれ複数の1／6～1／10波長の長さの線路からなり、それぞれの複数の線路の一端及び多端が互いに接続されて構成され、前記第3及び第4の結合線路は前記第1及び第2の結合線路を構成する前記複数の線路の2つ及び1つの線路にそれぞれ結合する1／6～1／10波長の長さの複数の線路からなり、それぞれの一端及び他端が互いに接続されて構成されていることを特徴とする請求項1記載のミキサー回路。

【請求項3】 一端が第1の入力端子に接続された1／3～1／5波長の長さの線路及び一端が開放端に構成された1／3～1／5波長の長さの線路からなりそれぞれの他端が直接又は線路を介して接続された第1及び第2の結合線路と、前記第1及び第2の結合線路にそれぞれ結合し一端が短絡され他端が平衡端子となる1／3～1／5波長の長さの第3及び第4の結合線路と、前記第3及び第4の結合線路の平衡端子にそれぞれ1／3～1／5波長の長さの線路を介して接続された一対の直列接続ダイオードと、前記直列接続ダイオードの接続点に一端が接続され他端に第2の入力端子が接続された線路と、前記直列接続ダイオードの接続点又は該接続点に接続された前記線路に低域濾波器を介して接続された出力端子とを有することを特徴とするミキサー回路。

【請求項4】 前記第1及び第2の結合線路はそれぞれ複数の1／3～1／5波長の長さの線路からなり、それぞれの複数の線路の一端及び他端が互いに接続されて構成され、前記第3及び第4の結合線路は前記第1及び第2の結合線路を構成する前記複数の線路の2つ及び1つにそれぞれ結合する1／3～1／5波長の長さの複数の線路からなり、それぞれの一端及び他端が互いに接続されて構成されていることを特徴とする請求項3記載のミキサー回路。

【発明の詳細な説明】

【0001】

【産業上の利用分野】本発明はマイクロ波、及びミリ波の無線通信装置に用いられるミキサー回路に関する。

【0002】

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【従来の技術】一般にシングルバランス型のミキサ回路は図8に示すように構成される。図8において49は局部発信周波数信号（以下局発信号）入力端子、50は高周波信号（以下ＲＦ信号）入力端子、51は中間周波数信号（以下ＩＦ信号）出力端子、52は不平衡信号を平衡信号に変換するバラン、53，54はミキサダイオード、55はダイオードの中点、56は局発信号及びＲＦ信号を阻止してＩＦ信号のみ通過させるローパスフィルター（以下ＬＰＦ）、57，58は接続点である。局発信号入力端子49に印加された局発信号はバラン52によって平衡モードに変換され、接続点57，58に加わり、ダイオードを駆動する。入力端子50よりＲＦ信号はダイオードに加えられ、ダイオードで発生するＩＦ信号はＬＰＦ56を通ってＩＦ出力端子51より出力される。

【0003】ミキサ回路をマイクロ波帯で実現する場合、従来の技術では不平衡モードを平衡モードに変換するバランにはラットレース回路やブランチライン回路等をマイクロストリップラインで同一平面上に構成したものや、スロットラインでマイクロ波集積回路（ＭＩＣ）基板の両面にパターンを形成して構成したものが用いられている。

【0004】図9はラットレース回路をバランに用いたシングルミキサであり、59は局発信号入力端子、60はＲＦ信号入力端子、61はＩＦ信号出力端子、62，63はミキサダイオード、64～67は接続点、68はＩＦ信号を通過させるＬＰＦである。接続点64～65，65～66，66～67間は使用周波数の1／4波長の線路長であり、接続点67～64間は3／4波長の線路長である。局発信号は入力端子59より入力され、接続点64，66に現れるが、このとき接続点64と66の信号の位相差は180°であり平衡モードとなってミキサダイオード62，63に加わる。

【0005】

【発明が解決しようとする課題】上記のようなラットレース回路を用いたミキサー回路はマイクロストリップラインにより平面回路化には向くが、その形状から場所をとり小型化には向かない。また、特性のとれる帯域も比較的狭い。スロットラインで構成した場合はＭＩＣ基板の両面を利用した立体的なものとなり平面回路に比べ構成が複雑になる。

【0006】上記の一般的によく用いられる不平衡－平衡変換回路の他に、使用周波数の1／4波長の結合伝送線路2つから構成され、2つの結合伝送線路のそれぞれ一端を短絡し、一端を開放にして互いに接続した180°移相器はマーチャントバランと呼ばれ、広帯域で小型化が容易にできる。例えば、A Designer's Guide To Planer Mixer Baluns（Microwaves December 1979 p52～57）には、マーチャントバランを

用いてダブルバランスミキサーの構成にした例がある。しかし、ダブルバランス化するためにはバランを２ケ使用する必要があり、さらに前記論文の例に見られるように、ダイオードへの配線が立体的になり、バランの平面化の効果が無駄になってしまう。ダブルバランス構成のメリットは信号入力と局発信号入力、局発信号入力とＩＦ出力、信号入力とＩＦ出力のミキサーのすべての端子においてアイソレーションがとれており、負荷の接続によるミキサー特性の変動が少ないことであるが、信号入力と局発信号入力、局発信号入力とＩＦ出力の２つのアイソレーションをとるシングルバランス構成でもミキサーの特性に特に重要な局発信号の負荷条件が決まるため十分実用的であり、バランも１個で済むため構成も単純になる。

【０００７】図１０にマーチャントバランを用いたシングルバランスミキサの回路構成を示す。６９は局発信号入力端子、７０はＲＦ信号入力端子、７１はＩＦ信号出力端子、７２，７３はマーチャントバランで２つの１／４波長結合伝送線路を持つ。７４，７５はミキサダイオード、７６はＩＦ周波数を通すＬＰＦ、７７，７８はマーチャントバランとミキサダイオードとの接続点、７９はダイオード７４，７５の中点である。６９より入力された局発信号は線路７２ａと７２ｂ、７３ａと７３ｂとの結合により平衡モードに変換され、接続点７７，７８に加わり、ダイオードを駆動する。入力端子７０より入力されたＲＦ信号はダイオードに加えられ、ダイオードで発生するＩＦ信号はＬＰＦ７６を通ってＩＦ出力端子７１より出力される。

【０００８】図１１に図１０の回路構成で５ＧＨｚで設計しアルミナ基板上に試作したＭＩＣの変換損失特性を示す。１／４波長はおおよそ５．４ｍｍである。図１１に示すように５ＧＨｚの局発信号を１５ｄＢｍ入力しても変換損失は－１５ｄＢ程度であり、ミキサとしては良い性能ではない。また、図１２にこのＭＩＣのリターンロス特性を示す。同特性からわかるように５ＧＨｚ近傍において、リターンロスが極めて不十分（反射信号が大）である。

【０００９】このように図１０の回路構成ではＲＦ信号入力端子側からみたインピーダンスは設計周波数で開放状態にあり、信号との整合状態が良くないことがわかる。

【００１０】本発明は従来の以上のような問題を解決するもので、平面回路で構成されるシングルバランス型ミキサにおいて、低局発信号レベルで広帯域に低変換損失を実現し、また、より小型化を可能とすることを目的とする。

【００１１】

【課題を解決するための手段】本発明は上記課題を解決するため、ミキサー回路において、一端が第１の入力端子に接続された１／６～１／１０波長の長さの線路及び

一端が開放端に構成された１／６～１／１０波長の長さの線路からなりそれぞれの他端が直接又は線路を介して接続された第１及び第２の結合線路と、前記第１及び第２の結合線路にそれぞれの結合し一端が短絡され他端が平衡端子となる１／６～１／１０波長の長さの第３及び第４の結合線路と、前記１／６～１／１０波長の長さの結合線路の平衡端子に接続された一対の直列接続ダイオードと、前記直列接続ダイオードの接続点に接続された第２の入力端子と、前記直列接続ダイオードの接続点に低域遮波器を介して接続された出力端子を有することを特徴としている。

【００１２】また、他の手段として、一端が第１の入力端子に接続された１／３～１／５波長の長さの線路からなりそれぞれの他端が直接又は線路を介して接続された第１及び第２の結合線路と、前記第１及び第２の結合線路にそれぞれ結合し一端が短絡され他端が平衡端子となる１／３～１／５波長の長さの第３及び第４の結合線路と、前記第３及び第４の結合線路の平衡端子にそれぞれ１／３～１／５波長の長さの線路を介して接続された一対の直列接続ダイオードと、前記直列接続ダイオードの接続点に一端が接続され他端に第２の入力端子が接続された線路と、前記直列接続ダイオードの接続点又は該接続点に接続された前記線路に低域遮波器を介して接続された出力端子とを有することを特徴としている。

【００１３】更に、前記両ミキサー回路手段において、前記第１及び第２の結合線路はそれぞれ複数の線路からなり、それぞれの複数の線路の一端及び他端が互いに接続されて構成され、前記第３及び第４の結合線路は前記第１及び第２の結合線路を構成する前記複数の線路の２つ及び１つにそれぞれ結合する複数の線路で構成され、それぞれの一端及び他端が互いに接続されて構成されていることを特徴としている。

【００１４】

【実施例】以下図面を参照しながら本発明の実施例について説明する。

【００１５】図１は本発明の一実施例におけるミキサー回路の回路図である。図１において従来の図１０の構成と異なる点は使用したマーチャントバランが設計周波数の１／４の波長ではなく、略１／８波長の結合伝送線路２つから構成される点である。

【００１６】即ち、結合伝送線路は、局発信号入力端子１に一端が接続された略１／８の波長の長さの結合線路４ａと、一端が開放端に構成された略１／８波長の結合線路５ａを有し、それぞれが他端（中央）において結合された全体として略１／４波長の不平衡線路と、前記略１／８の波長の長さの結合線路４ａ、５ａとそれぞれ結合され一端が短絡され他端が平衡端子１０、１１とされた略１／８波長の長さの結合線路４ｂ、５ｂとから成る結合線路４、５の構成を有している。

【００１７】また前記平衡端子１０、１１間にはミキサ

ーダイオード6、7が直列接続され、その接続点には伝送線路、低域フィルタ8等を介してそれぞれRF信号入力端子2、IF信号出力端子3が接続されている。

【0018】図2は図1に示したミキサ回路をアルミナ等の誘電体基板上に形成したMICパターンで構成した他の実施例である。

【0019】図2のミキサ回路は、結合線路15、16の構成を複数の結合線路の複合構成としている。不平衡側の線路は4つの略1／8波長の長さの線路をH形状に接続、配置しており、開放端及び信号入力端をそれぞれワイヤーボンデイング等により接続した構成とし、また、平衡側の線路は4つの略1／8波長の長さの線路をコ形状に接続、配置し互いの接続線路部を短絡し、また互いの開放端をそれぞれワイヤーボンデイング等により接続した構成とし、両線路は互いにかみ合わせた構成の結合線路15、16としている。

【0020】また、平衡端子21、22間にはミキサーダイオード17、18が直列接続され、その接続点20には伝送線路と低域フィルタ19の複合線路等を介してそれぞれRF信号入力端子13、IF信号出力端子14が接続されている。結合線路15、16は設計周波数の略1／8波長の不平衡側の開放伝送線路と平衡側の略1／8波長の短絡伝送線路2つからなるマーチャントバランを構成しており、又低域フィルタ19はRF信号及び局発信号を阻止しIF信号を通過させるものである。

【0021】このような結合線路の複合構成をとることにより、不平衡平衡の結合特性を良好にし、平衡側のバランスを一層向上でき、又インピーダンス整合を改善できる。

【0022】図2の回路構成を5GHzで設計しアルミナ基板上に試作したMICの変換損失の周波数特性と局発信号レベル依存性を図3に示す。局発信号レベル5dBmで変換損失は飽和し、変換損失は6dB程度である。帯域は設計周波数5GHzに対し4．2～5．7GHzを得た。従来の図10の構成の特性に比較して大きな改善がみられた。RF信号端子から見たリターンロスの局発信号レベル依存を調べると、図4のように低局発信号レベルで、RF端子から見たリターンロスは大きく変化し、設計周波数5GHz帯で最も良くなる。従来の図10の構成に比べて大きく改善している。また、通常マーチャントバランの線路長を半分にしてインピーダンス整合を改善しているため、バランの平面回路の面積は従来の約半分になり、小型化できる。

【0023】図5は本発明の他の実施例のミキサー回路の回路図である。図5において従来の図10の構成と異なる点は通常のマーチャントバランの平衡側端子34、35とミキサダイオード30，31との間に使用周波数の略1／4波長の伝送線路28，29を設けている点である。

【0024】平衡側の結合線路は略1／4波長の長さでありインピーダンスが高いが、その平衡端子に更に略1／4波長の線路28，29を接続することによりダイオード側から見た伝送線路長を長くし、結果的にインピーダンスを下げ整合性を高めることを可能にしている。

【0025】図6は図5に示したミキサー回路をアルミナ等の誘電体基板上に形成したMICパターンで構成した他の実施例である。36は局発信号入力端子、37はRF信号入力端子、38はIF信号出力端子、39，40は通常の1／4波長短絡伝送線路2つからなるマーチャントバラン、41，42は1／4波長伝送線路、43，44はミキサダイオード、45はIF信号を通過させるLPFである。

【0026】結合線路を図2と同様の複合線路の構成とし平衡出力端の平衡性の向上とインピーダンス整合を改善している。

【0027】図6の回路構成を5GHzで設計しアルミナ基板上に試作したMICの変換損失の周波数特性の局発信号レベル依存性を図7に示す。従来に比べ、図1の実施例とほぼ同程度のミキサーの特性の改善が見られ、低局発信号レベルで広帯域に低変換損失のミキサー回路を平面回路に実現できた。

【0028】上述の各実施例において、結合線路の線路長として1／8波長又は1／4波長の長さを採用した例でミキサー回路を説明したが、設計周波数の数分の一波長の長さの結合線路を用いたマーチャントバランを基本構成とした本発明においては、広帯域性とインピーダンス整合特性に優れ、入出力回路との整合を考慮することにより所望の特性を引き出すのは容易であることから、線路長は必ずしも正確に設計周波数の1／8波長又は1／4波長の長さにする必要はなく、その前後の長さでも所望の性能を十分実現できる。

【0029】本発明の設定範囲としては、1／8波長の線路については1／6波長から1／10波長の範囲で、又1／4波長の線路の場合は1／3波長から1／5波長の範囲で実施することが可能である。また、本発明の結合線路の平衡側構成としては、それぞれの短絡端側と平衡端側を互いに替えた2個の結合線路で構成しても実施できることは明らかである。

【0030】

【発明の効果】以上のように、マーチャントバランとダイオード等の非線形素子を用いたミキサ回路においてマーチャントバランを使用周波数の略1／8波長の結合伝送線路2つから成るものにして構成するか、または通常の略1／4波長の結合伝送線路2つからなるマーチャントバランの平衡端子と非線形素子の間に略1／4波長の伝送線路を設けることにより、ミキサ回路の入力信号及び局発信号に対するインピーダンス整合を改善し、低局発信号レベルで動作する、広帯域な低変換損失のミキサ回路を平面回路で小型に実現できる。またこの発明は、精度の高い結合線路の実現が容易なモノリシックマイク

ロ波集積回路に特に適しており、装置の小型化を図ることが可能である。

【図面の簡単な説明】

【図1】本発明の一実施例の回路図である。

【図2】ＭＩＣ回路パターンで構成した他の実施例を示す図である。

【図3】図1におけるミキサー回路の変換損失の周波数特性の局発信号レベル依存性を示す特性図である。

【図4】図1におけるミキサー回路のＲＦ信号端子から見た局発側のインピーダンスの特性図である。

【図5】本発明の他の実施例の回路図である。

【図6】ＭＩＣ回路パターンで構成した他の実施例を示す図である。

【図7】図5におけるミキサー回路の変換損失の周波数特性の局発信号レベル依存性を示す特性図である。

【図8】従来のシングルバランス型ミキサーの回路図である。

【図9】従来のラットレース回路を用いたシングルバランス型ミキサーの回路図である。

【図10】従来のマーチャントバランを用いたシングルバランス型ミキサーの回路図である。

【図11】図10の回路構成によるミキサーの変換損失の局発信号レベル依存性を示す特性図である。

【図12】図10の回路構成におけるミキサダイオードの中点から局発側を見たインピーダンスの特性図である。

【符号の説明】

1，12，23，36　局発信号入力端子

2，13，24，37　ＲＦ信号入力端子

3，14，25，38　ＩＦ信号出力端子

4，5，15，16，26，27，39，40　バラン

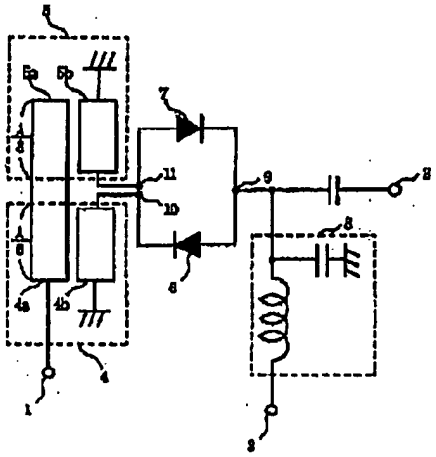
6，7，17，18，30，31，43，44　ミキサダイオード

8，19，32，45　ローパスフィルター

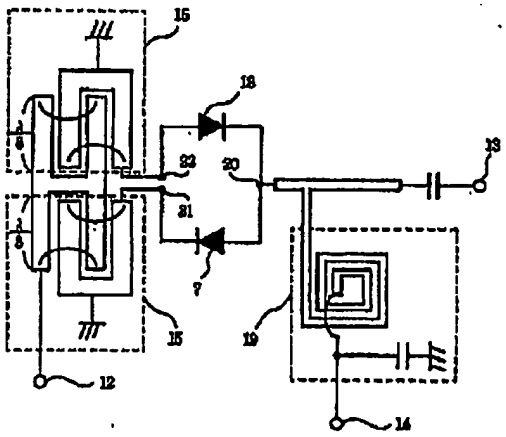
9，20，33，46　ミキサダイオードの中点

10，11，21，22，34，35，47，48　バランとダイオードの接続点

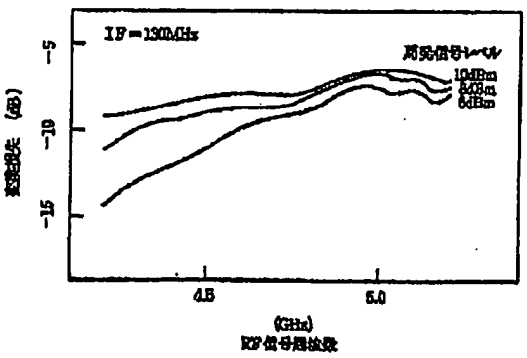
【図1】



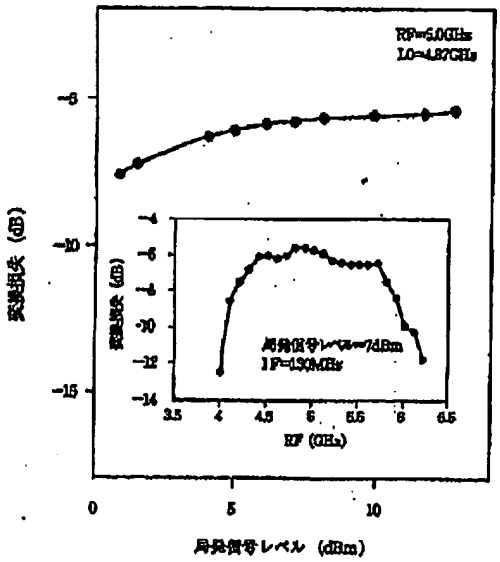
【図2】



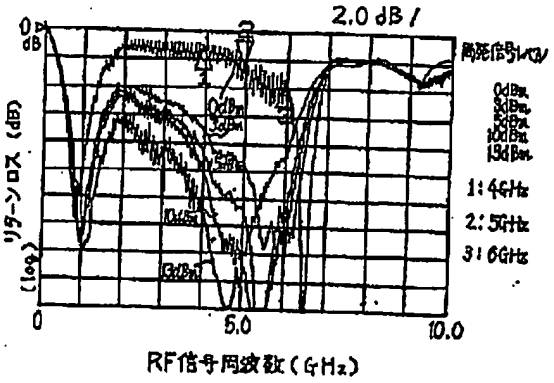
【図7】



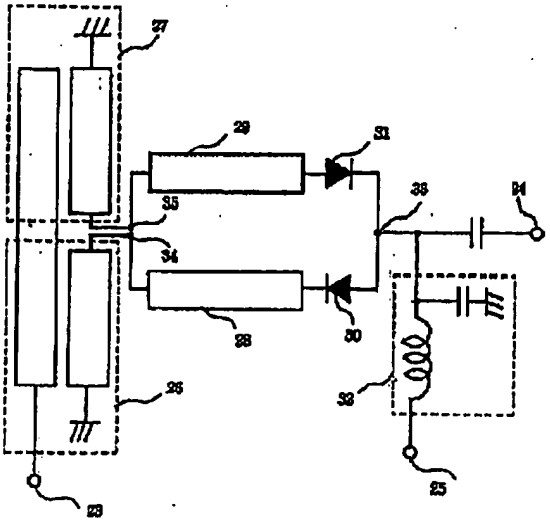
【図3】


RF=5.0GHz
LO=4.87GHz
変換損失 (dB)
局発信号レベル (dBm)
IF=130MHz
RF (GHz)

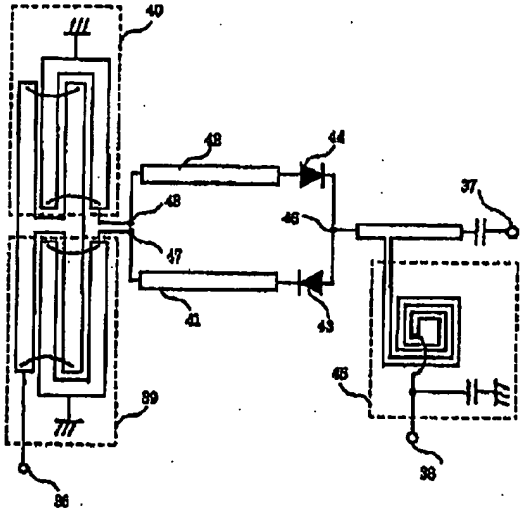
【図4】


2.0 dB /
アイソロス (dB)
RF信号周波数 (GHz)
1: 4GHz
2: 5GHz
3: 6GHz

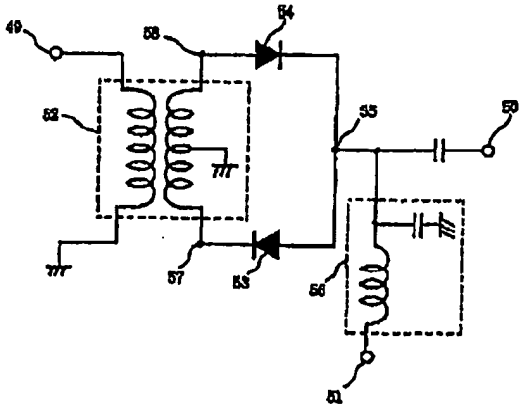
【図5】


27
29
31
35
36
34
28
30
32
26
25
23

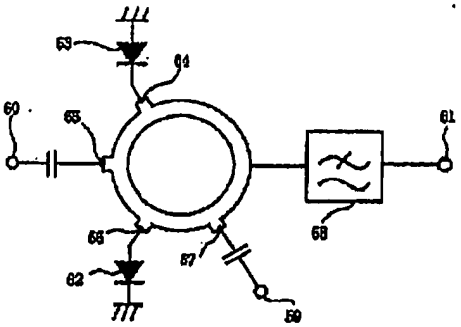
【図6】


40
42
44
48
46
37
47
41
43
45
39
38
36

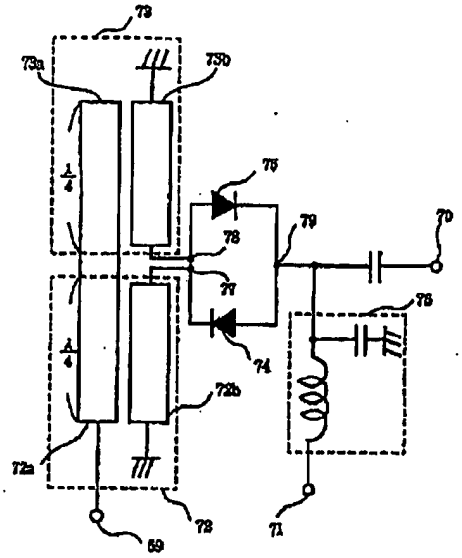
【図8】


49
54
58
52
55
50
57
53
56
51

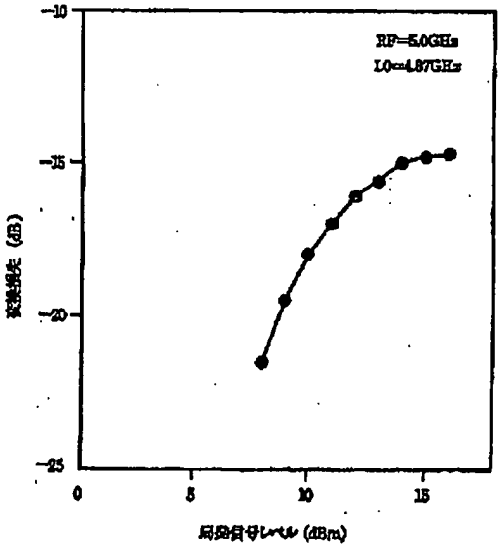
【図９】



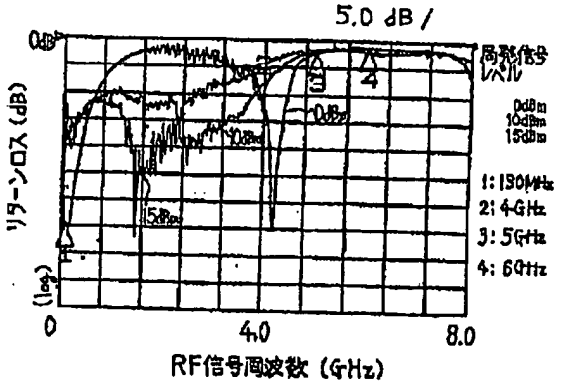
【図１０】



【図１１】



【図１２】



* NOTICES *

CLAIMS

[Utility model registration claim]

[Claim 1] The 1st and the 2nd terminal train which consist of two or more terminals projected at intervals of predetermined, respectively from the 1st and 2nd edges of the direction of a long side where an IC package counters, In mixing / IC for local oscillation which has the mixed section which mixes the local oscillation section which oscillates the local oscillation signal of predetermined frequency, and the RF signal inputted and said local oscillation signal, and outputs an intermediate frequency signal The edge side of the same direction of a shorter side of said IC package each among each terminal of said 1st and 2nd terminal trains two terminals prepared in the very end From the terminal belonging to a terminal train which considers as the terminal to which the external components which constitute the resonance circuit of said local oscillation section are connected, and is mutually [said 1st and 2nd terminal trains] different, while inputting said RF signal In said 1st or 2nd terminal train to which the terminal into which said intermediate frequency signal is outputted and said RF signal is inputted belongs Between the terminal into which said RF signal is inputted, and the terminal with which the external components which constitute the resonance circuit of said local oscillation section are attached The terminal array of mixing / IC for local oscillation characterized by preparing at least one terminal connected to the touch-down pattern of a printed circuit board with which this mixing / IC for local oscillation are wired.

[Translation done.]

NOTICES *

JPO and NCIPI are not responsible for anydamages caused by the use of this translation.
1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

DETAILED DESCRIPTION

[Detailed explanation of a design]
[0001]
[Industrial Application]
This design is related with the terminal array of mixing / IC for local oscillation which has the function which mixes the RF signal and local oscillation signal which are inputted, and outputs an intermediate frequency signal while it is used for a tuner, a transmitter, etc. and oscillates the local oscillation signal of predetermined frequency.
[0002]
[Description of the Prior Art]
Drawing 5 is the schematic diagram showing an example of the terminal array of the conventional mixing / IC for local oscillation. In this drawing, 1 is an IC package and the terminal train 2 which consists of two or more terminals 21-25 prepared at intervals of predetermined, and the terminal train 3 which consists of two or more terminals 31-35 prepared at intervals of predetermined have projected it, respectively from the edges 1a and 1b of that direction of a long side.
[0003]
In the terminal train 2, the local oscillation section external component mounting terminal with which the external component group 4 by which terminals 21-24 are connected to the local oscillation section inside mixing / IC for local oscillation is attached, and a terminal 25 are earth terminals connected to the touch-down on a printed circuit board.

The external component group 4 consists of coil 4a and capacitor 4b which constitute the resonance circuit of the local oscillation section inside mixing / IC for local oscillation, and is attached in the terminals 21-24 projected from the same edge 1a of IC package 1. Moreover, in the terminal train 3, the intermediate frequency signal output terminal to which the intermediate frequency signal with which 31 and 32 are outputted from the mixed section inside mixing / IC for local oscillation is outputted, the supply voltage impression terminal with which, as for 33, supply voltage is impressed, and terminals 34 and 35 are RF signal input terminals into which a RF signal is inputted.

[0004]

[Problem(s) to be Solved by the Device]

By the way, generally the number of terminals of IC is designed by the necessary minimum number from the size of a semiconductor chip, and the field of cost. Hereafter, the number of terminals of IC, the size of a semiconductor chip, and relation with cost are explained.

IC is packed by mold, and in order to connect an internal circuitry with an external circuit, it is necessary to make terminals 21-25, and 31-35 project from the edges 1a and 1b of IC package 1 generally, as mentioned above.

[0005]

However, depending on the size of IC package 1, the number of terminals has a limit, and when extreme, it will be necessary somewhat to enlarge size of IC package 1 by 1 terminal **********.

Moreover, although it is necessary to enlarge size of a semiconductor chip since 1 terminal ****** and the bonding pad of a semiconductor chip naturally also increase, thereby, the yield of IC will fall.

These [both] cause a cost rise of IC.

For the reason explained above, since the number of terminals of IC thinks the size of a semiconductor chip, and the field of cost as important and is designed at the necessary minimum number, un-arranging, as shown below has produced it from the former.

[0006]

First, in the terminal array of the conventional mixing / IC for local oscillation mentioned above, since it is constituted so that it may be attached in the terminals 21-24 which the external component group 4 projected from the same edge 1a of IC package 1, as for the pattern on the printed circuit board connected to terminals 21-24, leading about of some is needed.

Therefore, the part in which this pattern was taken about is the signal of for example, a

UHF band.

It is alike, and it may receive and may become an unnecessary inductance. There was a problem that that this changes from a frequency predetermined in an oscillation frequency to other frequencies when the internal circuitry of IC is the local oscillation section of a broadband especially, or an oscillation stops, or the adjustable range of a frequency runs short etc. will do the serious effect for the engine performance of an internal circuitry.

[0007]

Moreover, in the terminal array of the conventional mixing / IC for local oscillation mentioned above, since the intermediate frequency signal output terminals 31 and 32 and the RF signal input terminals 34 and 35 be close, isolation sufficient among these terminals could not be took, but there be a problem that the active jamming component which leak from the radio-frequency head which constitute the internal circuitry of mixing / IC for local oscillation to the intermediate frequency section will worsen S/N of an intermediate frequency signal.

This design aims at offering the terminal array of mixing / IC for local oscillation which can fully take the isolation between internal circuitries, without having been made under such a background and having serious effect for the engine performance of an internal circuitry.

[0008]

[Means for Solving the Problem]

The 1st and the 2nd terminal train which consist of two or more terminals which projected this design at intervals of predetermined, respectively from the 1st and 2nd edges of the direction of a long side where an IC package counters, In mixing / IC for local oscillation which has the mixed section which mixes the local oscillation section which oscillates the local oscillation signal of predetermined frequency, and the RF signal inputted and said local oscillation signal, and outputs an intermediate frequency signal The edge side of the same direction of a shorter side of said IC package each among each terminal of said 1st and 2nd terminal trains two terminals prepared in the very end From the terminal belonging to a terminal train which considers as the terminal to which the external components which constitute the resonance circuit of said local oscillation section are connected, and is mutually [said 1st and 2nd terminal trains] different to said RF signal

In said 1st or 2nd terminal train to which the terminal into which said intermediate frequency signal is outputted and said RF signal is inputted while inputting belongs It is characterized by preparing at least one terminal connected to the touch-down pattern

of a printed circuit board with which this mixing / IC for local oscillation are wired between the terminal into which said RF signal is inputted, and the terminal with which the external components which constitute the resonance circuit of said local oscillation section are attached.

[0009]

[Function]

Since the external components which constitute the resonance circuit of the local oscillation section cannot become the hindrance of connection of the external components connected to other terminals easily according to the above-mentioned configuration, leading about of the pattern of other external components on a printed circuit board can be lessened, un-arranging about oscillation actuation of the local oscillation section is improved, and adjustment of an oscillation frequency can also fully be performed.

Moreover, since the isolation of the radio-frequency head inside mixing / IC for local oscillation and the intermediate frequency section is high, the active jamming component which leaks from a radio-frequency head to the intermediate frequency section can be decreased.

Furthermore, since the isolation between a radio-frequency head and the local oscillation section is improved, S/N of an intermediate frequency signal improves.

[0010]

[Example]

First, before explaining one example of this design, the fundamental view for solving the technical problem mentioned above is explained. Drawing 3 is the schematic diagram showing the general example of the terminal array of mixing / IC for local oscillation. Two or more terminals 61, 62, ..., 6n which 5 is an IC package and were prepared at intervals of predetermined in this drawing from the edges 5a and 5b of that direction of a long side, 6n+1, 6n+2, and the terminal train 6 that consists of ..., The terminal train 7 which consists of two or more terminals 71, 72, ..., 7n prepared at intervals of predetermined, 7n+1, 7n+2, and ... has projected, respectively.

[0011]

And the technical problem mentioned above is solvable by considering as a terminal with which are satisfied of the conditions which show each terminal of these terminal trains 6 and 7 below.

** two local oscillation section external component mounting terminals to which the both ends of the coil which constitutes the resonance circuit of the local oscillation section inside mixing / IC for local oscillation are connected -- each by the side of the

edge of the same direction of a shorter side of IC package 5 among each terminal of the terminal trains 6 and 7 -- consider as the terminal in the very end.

[0012]

** Two high frequency signal input terminals and two intermediate frequency signal output terminals are taken as the terminal projected from the edge of the direction of a long side where IC packages 5 differ, respectively.

** Prepare at least one terminal connected to the touch-down pattern of a printed circuit board in the edge of the direction of a long side of IC package 5 in which two high frequency signal input terminals are prepared between two high frequency signal input terminals and local oscillation section external component mounting terminals. In addition, this terminal does not necessarily need to be connected to the internal circuitry of mixing / IC for local oscillation.

[0013]

Here, an example of the terminal array of IC which satisfies condition ** mentioned above to drawing 4 - ** is shown.

In this drawing, the same sign is attached to the part corresponding to each part of drawing 3 , and that explanation is omitted. In drawing 4 , 8 is a coil which constitutes the resonance circuit of the local oscillation section inside mixing / IC for local oscillation, and it connects with the local oscillation section external component mounting terminal 61 which has an end in the very end by the side of edge 5c of the direction of a shorter side of IC package 5 of the terminal train 6, and it is connected to the local oscillation section external component mounting terminal 71 which has the other end in the very end by the side of edge 5c of the direction of a shorter side of IC package 5 of the terminal train 7. That is, the conditions of ** mentioned above are satisfied.

Moreover, as for an intermediate frequency signal output terminal and 7n of terminals, as for 6n of terminals, and 6n+1, an earth terminal, terminal 7n+1, and 7n+2 are RF signal input terminals, and these have satisfied the conditions of ** mentioned above and **.

[0014]

Hereafter, one example of this design is explained with reference to a drawing. Drawing 1 is the schematic diagram showing the configuration of the terminal array of mixing / IC for local oscillation by one example of this design, attaches the same sign to the part corresponding to each part of drawing 4 in this drawing, and omits that explanation. In drawing 1 , 9-11 are capacitors which constitute the resonance circuit of the local oscillation section inside mixing / IC for local oscillation, respectively, the end of a

capacitor 9 is connected to a terminal 61, the other end is connected to a terminal 62, the end of a capacitor 10 is connected to a terminal 71, the other end is connected to a terminal 72, the end of a capacitor 11 is connected to a terminal 62, and the other end is connected to the terminal 72.

Moreover, terminals 64 and 65 are [an earth terminal and the terminals 74 and 75 of an intermediate frequency signal output terminal and a terminal 73] RF signal input terminals, respectively.

[0015]

Next, an example of the equal circuit of mixing / IC for local oscillation is shown in drawing 2 . In this drawing, the same sign is attached to the part corresponding to each part of drawing 1 , and that explanation is omitted. 14 is the buffer amplifier of the local oscillation section in which 12 oscillates the local oscillation signal of predetermined frequency in drawing 2 , and the differential amplifier mold with which 13 amplifies a local oscillation signal, and a RF signal inputted.

It is the mixed section which mixes the local oscillation signal outputted from the buffer amplifier 13, and outputs an intermediate frequency signal.

[0016]

In the local oscillation section 12, FET the RF oscillation to which, as for 15a and 15b, the property was equal, respectively, and for magnification, and 16 and 17 are drain resistance. And the local oscillation sections 12 are FET 15a and 15b, capacitors 9-11, and a differential amplifier mold grounded drain mold oscillator that becomes coil 8 list from resistance 16 and 17, and output two oscillation signals with 180-degree phase contrast.

Moreover, the mixed section 14 consists of the double-balanced mixer section 21 which consists of FET 18a, 18b, 19a, 19b, 20a, and 20b, and a current regulator circuit 24 which consists of FET22 and resistance 23.

[0017]

Since the coil 8 which constitutes the resonance circuit of the local oscillation section 12 cannot become the hindrance of connection of the external components connected to other terminals easily due to the conditions of ** mentioned above according to such a configuration, leading about of the pattern of other external components on a printed circuit board can be lessened.

Moreover, according to the conditions of ** mentioned above, since it is easy to double the physical dimension of a coil 8 with the distance between terminals, leading about of the pattern of this part on a printed circuit board can be lessened.

Therefore, when the local oscillation section 12 is the local oscillation section of the

broadband of for example, a UHF band, un-arranging about the oscillation actuation which existed conventionally [of an oscillation frequency changing from a predetermined frequency to other frequencies, an oscillation stopping, or the adjustable range of a frequency running short] is improved, and adjustment of an oscillation frequency can also fully be performed.

[0018]

Furthermore, according to the conditions of ** mentioned above, since a coil 8 does not approach a radio-frequency head and the intermediate frequency section beyond the need, it can lessen with [to the radio-frequency head or the intermediate frequency section of the signal emitted from a coil 8] a jump.

In addition, according to the conditions of ** mentioned above, since the isolation of a radio-frequency head and the intermediate frequency section is high, the active jamming component which leaks from a radio-frequency head to the intermediate frequency section can be decreased.

[0019]

Moreover, since the RF signal input terminals 74 and 75 are approached and the earth terminal 73 is formed according to the conditions of ** mentioned above, it connects with the touch-down pattern with which it was formed in the printed circuit board near the semiconductor chip of FET 20a and 20b of a radio-frequency head, the heat dissipation effectiveness of a radio-frequency head improves, and thermal noise is improved.

Furthermore, the isolation between a radio-frequency head and the local oscillation section 12 is improved according to the conditions of ** mentioned above.

Therefore, S/N of an intermediate frequency signal improves.

In addition, although the example which connected the coil 8 to terminals 61 and 71 was shown, it is not limited to this but you may make it connect to terminals 61 and 71 the circuit block with which the impedance operates as an inductance as a whole in one example mentioned above.

[0020]

[Effect of the Device]

It is effective in the ability to fully take the isolation between internal circuitries, without having serious effect for the engine performance of an internal circuitry according to this design, as explained above.

[Translation done.]